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## Negative Ion Measurement with a Laser Irradiated Double Probe
ダブルプローブレーザ光脱離による負イオン計測法

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Photodetachment signals of negative ion containing plasma are commonly detected by single electrode electrostatic probes biased at positive potential with respect to the local plasma potential. Even in the case that the probe is biased negatively to collect positive ions, the electrical potential structure of the sheath formed around the probe tip changes in accordance with the detachment reaction of negative ions. A double probe configuration has been employed to detect a small difference arising from irradiation of laser beam onto one electrode. Possibilities to quantify parameters of negative ion containing plasmas are discussed.

### 1. Introduction

Electrostatic probes are biased positively to measure increment in electron current upon irradiation of laser light to measure negative ion density in plasma. Positively biased probes exhibit sizable noise onto photodetachment signal, and photodetachment signal detection is attempted while biasing electrostatic probe negatively. In particular, change in floating potential will be measured by utilizing a double probe. Quiescent plasma should enable one to detect small photodetachment signals.

### 2. Experimental set up

A 160 mm diameter 300 mm long stainless steel discharge chamber is used confine negative ion containing plasma. The cylindrical side wall of the chamber is surrounded by 16 rows of Sm-Co magnets. One end of the chamber is attached to 7 rows of magnets, while the wall of the other end is electrically floated. Two tungsten filaments serve as hot cathodes for hydrogen discharge, while cold hollow cathodes are used to excite oxygen plasmas.

Two kinds of lasers can deliver photons into the discharge chamber to detach electrons from negative ions in the plasma. The one is pulse Nd-YAG laser to make pulse laser photodetachment measurement. The other is an amplitude modulated semiconductor laser for DC photodetachment measurement. These lasers are introduced into the center of the discharge chamber through a vacuum window to intersect perpendicularly the axis along which the probe is moved.

### 3. Double probe measurement

Two electrodes of a double probe are aligned parallel, and one of the electrodes is shone by a laser beam, while the other is set outside of the laser path. Thus, one electrode is in the region where negative ions are photodetached, and the other one is in the region of unaffected plasma. As the electron mobility is larger in plasma region irradiated by the laser, a small potential difference is generated between the electrodes.

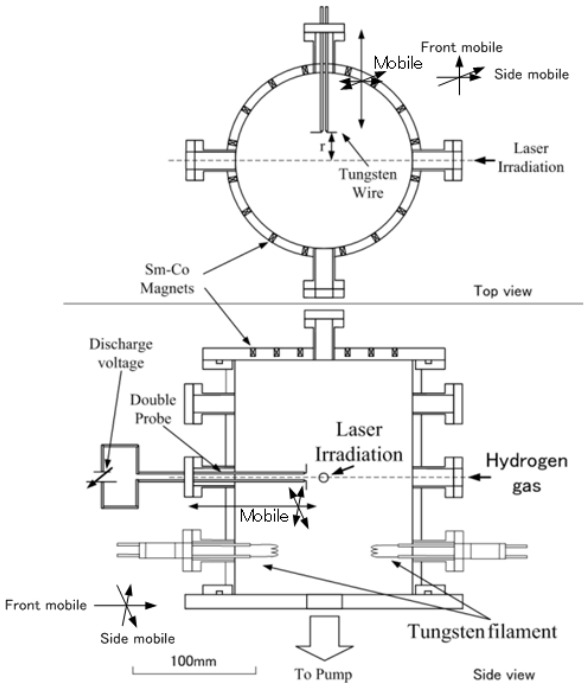


Fig. 1 Schematic diagram of the experimental apparatus